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BF—Business Article
CM—Components and Materials
CT—Comment
EN—Electronics Newsletter
ERS—Electronics Reference Sheet
MR—Marketing
PC—Picture with Caption
PT—Production Techniques
RD—Research and Development
SR—Special Report
TF—Technical Feature Article
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EDITORIAL ABSTRACTS

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January through June, 1961, Vol. 34

NOTE: Copies of all **electronics** articles are available at cost of 65c a page for individual reproduction (excepting special reprints c ..ole at reduced rates). For rap service, send requests to Reader Service Department **electronics**, 330 West 42nd Street, New York 36, N.Y., enclosing correct amount for number of pages, and listing title, page number and issue date of the article. The number of pages in feature articles published through June of this year is given in the abstracts.

JANUARY 6, 1961, ISSUE

The Electronics Market: Our Industry Today and Tomorrow, (38 pages)
by E. DeJongh ..... *p 67*
Includes sales forecasts of military and space, industrial, comsumer and components markets for 1961, 1962, 1965 and 1970. Analyzes selling methods employed by the electronics industry, market planning and international trade.

Electronic Traffic Control, (6 pages)
by E. K. Damon and R. L. Cosgriff .. p 109
A philosophy of guided evolution is needed to make traffic aids now being developed compatible with those of the future. Proposed electronic control systems for guidance, warning, braking, speed control and automatic steering that embody this concept are outlined.

Engineering Trends in Consumer Electronics, (3 pages)
by G. J. Flynn ..... *p 115*
Report of EIA's Radio Fall Meeting. Reviews of technical papers include details of new 10-pin and 12-pin tubes, circuits for battery-operated transistor tv sets and life data on entertainment transistors.

High Temperature Resonant-Cavity Dielectrometer, (2 pages)
by R. W. Sutton and N. Grechny, Jr., p 118
Measurements are made at temperatures to 2,500 F within accuracies of one percent for dielectric constant and five percent for loss-tangent. Resonant length of a tunable cavity is measured with sample inserted and then with sample removed. Materials tested included hypersonic radomes.

Measuring Parameters by Power Transistor Pulse Techniques, (3 pages)
by D. H. Breslow ..... *p 120*
Pulse or sweep methods developed reduce input power when testing high-power transistors. Test transistor bias is such that power pulses have high peak value, but average power and resultant heating is low. The pulse tester is described.

Sensitive Amplifier Helps Locate Tumors, (2 pages)
by E. Gordy, M.D., and G. Sieber . p 123
Uptake of certain radioactive compounds is different for normal tissue and tumors. A scintillation counter presents the tissue radiation level data as variations in blackness of photographic film when the film is exposed to a light spot of varying intensity, linked mechanically to the scintillation probe.

Thyratron Monitors Line-Voltage Dips, (1 page)
by T. D. Koranye ..... *p 126*
Simple thyratron circuit detects and counts short-duration, abrupt line-voltage dips. An alternate noncounting circuit which uses a special arrangement of neon lamps is also described.

JANUARY 13, 1961, ISSUE

Recent Progress in Magnetics, (5 pages)
by N. Lindgren, ... *p 81*
Report on Sixth Annual Conference on Magnetism and Magnetic Materials. Papers reviewed cover work in all-magnetic logic, compare ferrite cores and thin film memory elements, discuss preparation of thin films, ferromagnetic devices and studies of spiral walls in thin films.

Continuously-Variable Glass Delay Line, (2 pages)
by H. A. Brouneus and W. H. Jenkins .p 86
Delay line uses optically-polarized light to monitor the passage of an acoustic stress wave in glass. Glass under mechanical stress has different indices of refraction for polarized light parallel to and perpendicular to the direction of stress. Infinitely variable delay is obtained by the movement of a multiplier phototube readout element along the length of the glass delay line.

Measuring Antenna Impedance in the Ionosphere, (5 pages)
by O. C. Haycock and K. D. Baker .. p 88
Rocket-borne impedance measuring and telemetering system is used in research on antenna-impedance changes. Resistive and reactive components of antenna impedance are measured as the rocket moves through the ionosphere. Test antenna types are described.

High-Speed Automatic Diode Tester, (3 pages)
by E. V. Marrott and V. S. Zucco .. p 93
Mechanical design and typical test circuits are given for automatic tester that can check 18,000 diodes per day. Twelve parameters are measured; diodes that fall outside the parameter limits are automatically rejected. Good diodes are rereeled on tape rolls.

Voltage-to-Digits Conversion with Relays, (3 pages)
by T. L. Greenwood ..... *p 96*
A resistance series comprises a voltage divider controlled by relays, which operate to vary the ratio between the divider voltage and the unknown. The difference between the known and unknown voltages is applied to a polarized relay, and relays are operated in steps if the unknown voltage is greater. The operated relays control a printer.

Precision Variable Frequency Power Supply, (2 pages)
by E. A. Gilbert ..... *p 99*
Ballast tube is used in thermal regulating bridge with feedback circuits to control amplitude of output. An adjustable filter controls frequency from 50 to 2,400 cps. Short time stability of 0.02 percent is satisfactory for calibrating 0.1 percent instruments. Harmonic distortion is 0.5 percent at 100 v-a output and 1 percent at 200 v-a output.

Precise Delay Measurement, (1 page)
by H. T. McAleer ..... *p 102*
Input and output voltages of a delay device are observed simultaneously on an oscilloscope. Scope repetition rate is adjusted until the output pulse coincides with the next input pulse. The delay time is equal to the time interval between pulses, which is the period of the oscillator.

JANUARY 20, 1961, ISSUE

Medical Electronics Part I: Diagnostic Measurements, (7 pages)
by W. E. Bushor ..... *p 49*
Instruments and techniques used to translate physiological parameters into diagnostically significant form are outlined. Topics include instruments and transducers for analysis of heart, brain, blood, skin resistance, temperature, eye and intestinal conditions. Typical pickups and waveforms are pictured.

Using Voltage-Variable Capacitors in Modulator Design, (4 pages)
by A. C. Todd, R. P. Schuck and H.M. Sachs ..... *p 56*
Voltage-variable capacitors are used in cascade phase and single-sideband amplitude modulators. Design equations, circuits and test setups are presented. Phase modulators are linear over a deviation angle of ±25 degrees; ssb modulator has good linearity and acceptable suppression of unwanted frequencies.

Designing Low-Noise Antennas, (4 pages)
by R. Caldecott and W. H. Peake .. p 60
Antenna noise has become a design factor with the advent of low-noise receivers using parametric amplifiers and masers. Various sources of noise are considered, including the antenna temperature concept, solar noise and cosmic radiation. Practical examples of low-noise designs are given for tropospheric scatter and satellite communication antennas.

Flying-Spot Integrating Densitometer, (3 pages)
by E. M. Deeley ..... *p 64*
Density measurements of areas of photographic films, used in such studies as x-ray diffraction and cytology, are made by a flying-spot scanner. Density is measured by electro.. integration and the output is presente.. on a meter.

Using V.. .. to Suppress Relay Sparking, (3 pa..)
by R. de Proost and R. Servanckx .. p 68
After a theoretical introduction to relay contact spark suppression with varistor-capacitor combinations, three nomograms are presented. Three examples further explain

the use of the nomograms to solve spark suppression problems.

JANUARY 27, 1961, ISSUE

Parametric Amplifier for Space Probe Tracking, (5 pages)
by C. F. Brett ..... *p 41*
A special phase-locked, parametric amplifier receiver was designed to track the space probe, Pioneer V. The receiver has low noise and high sensitivity. A field test set and check of performance against a celestial radio source are also described.

Precisely Aligning Doppler Radar Antennas, (3 pages)
by J. F. Lane ..... *p 46*
Doppler radar for the B-58 determines velocity within 0.1 percent. Accuracy is obtained by aligning the system's six antennas in a special ground boresighting installation with an anechoic tunnel.

Ring Counter Uses Transistors, (3 pages)
by J. A. Pecar ..... *p 49*
Current response curve of the bistable circuit of a transistorized thyratron ring counter resembles that of a thyratron. Each stage has three transistors, four resistors and two diodes. Refined circuit has several advantages, including high-speed operation due to absence of capacitors.

Ultrasonic Equipment in Industry, (4 pages)
by S. Vogel ..... *p 52*
Characteristics, performance and transducers of ultrasonic cleaning, welding, soldering and machining equipment are surveyed. A summary of therapeutic uses and health safety precautions is included.

Gray-to-Binary Converter Handles Least Significant Bit First, (3 pages)
by G. D. Beinhocker ..... *p 56*
Gray-to-binary code conversion usually involves reversal of the output binary word since conventional converters require most-significant-bit input. The pocedure given permits least-significant-bit input, avoiding word-order reversal.

Fault-Indicating Series Regulator, (1 page)
by J. A. Wheeler and E. J. Currence .. *p 60*
Transistors in regulating circuits of a five-amp power supply have indicator lamps at their emitters. Evenly lit, out, or too-bright lamps indicate normal conditions, an open transistor, or a collector-to-emitter short.

FEBRUARY 3, 1961, ISSUE

Subsurface Communication for Survival, (3 pages)
by R. N. Ghose ..... *p 43*
Low-frequency point-to-point or broadcast communication from an underground transmitter provides security against natural and artificial hazards. Author outlines solutions of transmission and equipment design problems.

Medical Electronics Part II: Diagnostic Systems and Visualization, (6 pages)
by W. E. Bushor ..... *p 46*
Describes methods and equipment for monitoring, analyzing and interpreting physiological data and for internal viewing. Included are monitors, data processors, diagnostic computers, x-ray, radioisotope scanners, ultrasonography, infrared, tv and endoscopy.

Using Thermistors as Servo Elements, (4 pages)
by I. C. Hutcheon ..... *p 52*
Surveys a number of advantageous applications in control and measurement for solid-state servomechanism elements whose function is analagous to mechanical units. Basio circuit is a thermistor potentiometer.

New Sonar Thumper Charts Ocean Subbottom, (2 pages)
by L. H. Dulberger ..... *p 56*
Capacitor bank discharge produces movement of underwater plate, generating high-power sound pulse with maximum energy in low-frequency audio range. Sediment and bedrock are measured, using hydrophone pickup and continuous graph recording.

Digital Tone Filter with Infinite Rejection Slope, (1 page)
by A. Corbin ..... *p 58*
Bandpass slot filter, used as frequency or tone filter, has buildup time of one cycle regardless of input frequency or selectivity. In extreme, the filter can be adjusted to zero cycle bandwidth and infinite rejection slope.

Graphical Method Predicts Radio Interference, (4 pages)
by J. Vogelman ..... *p 60*
Predicting radio interference in an electronically-congested area like Cape Canaveral requires a great deal of data handling and computation. Methods given and illustrated by a simplified example reduce the labor of arriving at a prediction.

FEBRUARY 10, 1961, ISSUE

Automatic Beacon Radar Identifies Aircraft, (5 pages)
by W. L. Woodson ..... *p 57*
A new air traffic control beacon ground station, ATCBGS, is being installed by FAA. It automatically interrogates aircraft with transponders, decodes the returned information for the air traffic controller and identifies the aircraft on the controller's radar screen. Operation of the system is described.

What Designers Should Know about Transient Radiation, (4 pages)
by J. W. Clark, T. D. Hanscome and H. L. Wiser ..... *p 62*
Transient and cumulative effects of nuclear radiation on electronic circuits and the causes of circuit malfunction are described. The author outlines methods of designing radiation-resistant circuits and simulating nuclear weapons environments for lab testing.

New Klystron Design for Constant Repeller Voltage, (2 pages)
by P. M. Lally and L. Sandstrom ... *p 66*
Reflex klystron tuning range is increased to 10 percent of center frequency without changing repeller voltage. The tube's grid 2 is movable while grid 1 is held constant. Principle can be applied to all frequency ranges for gap-tuned reflex klystrons.

Designing Tunnel Diode Oscillators, (5 pages)
by Wen-Hsiung Ko ..... *p 68*
Analysis, designs and equivalent circuits are presented for a variety of tunnel diode oscillators, including frequency stabilized, sinusoidal, square wave, push-pull and cascade oscillators.

Plate Voltage Control of Phantastron Frequency, (2 pages)
by H. C. Whitworth ..... *p 73*
Two phantastrons are connected so that they each trigger the other at the end of plate rundown. This forms a free-running pulse generator circuit that will operate at about five pulses per second. Frequency is adjusted by control of the rundown starting voltage. The circuit is used, for example, in a data transmission decoder.

Measuring Dielectric Constant Graphically, (2 pages)
by R. Heimer ..... *p 76*
Dielectric constants may be measured accurately with a signal generator, slotted line and standing-wave indicator, rather than a more expensive dielectrometer. Graphs provided enable the dielectric constant of any low loss material to be found at X-band.

FEBRUARY 17, 1961, ISSUE

Self-Adaptive Filter Finds Unknown Signal in Noise, (3 pages)
by C. V. Jakowatz and G. M. White . *p 117*
After several random repetitive signals, the automatic system forms a memory of the signal. As the signal shape slowly changes, the memory is altered accordingly to create an optimum filter. The waveform generator which provides signals at random times is also described.

Designing Tunnel Diode R-F Amplifiers, (4 pages)
by E. D. Long and C. P. Womack .. *p 120*
Shorted quarter-wave filter made in stripline is combined with a tunnel diode amplifier to make a miniature r-f amplifier for an airborne receiver. It has insertion gain up to 25 db with very low noise figure. Fabrication and design methods are detailed.

Combining Remote Radars on a Central Display, (2 pages)
by G. E. Martin ..... *p 124*
Discusses the requirements of a system which brings the signals from three radars, via wideband data links, to a central control point. The signals are electronically combined and presented as a single map on a ppi tube, coordinating the interception of aircraft.

Patterns in Thin Films Make Fast Nondestructive Memories, (3 pages)
by J. W. Hart ..... *p 126*
Studies of domain behavoir, as photographed by the Kerr magneto-optic method, show that single irreversible domains can be formed within thin magnetic films. This permits the storage of binary information. Concept can be the basis of a nondestructive memory operating at rates exceeding 10 Mc.

Resins for Embedding Electronic Packaging, (3 pages)
by C. A. Harper ..... *p 130*
Tables describe resin fillers and their effects on the electrical, physical and environmental resistance characteristics of embedding resins. Effects of environmental extremes on epoxies, polyesters, polysulfides, silicones and foams are also tabulated.

Root-Mean-Square Sensing in Voltage Regulators, (2 pages)
by R. L. Frank ..... *p 133*
Direct voltage proportional to rms value of chopped sine or square waves is obtained from self-biased linear rectifier circuit intermediate in action between average and peak rectifiers. Close regulation over wide load or temperature range is obtained.

Transistor Amplifier Slide-Rule Calculator, (2 pages)
by J. Hallis, ... *p 136*
With this calculator, power input and output, transformer ratios and other transistor

amplifier data can be readily determined. The components of the calculator are printed on a single page so the reader can cut them out and assemble his own slide-rule.

FEBRUARY 24, 1961, ISSUE

Semiconductor Strain Gages Offer High Sensitivity, (3 pages)
by R. E. Talmo ..... *p 43*
Single crystal silicon strain gages provide sensitivities 10 to 100 times greater than metallic devices. Gage factors for various crystal orientations of silicon are presented and temperature variations detailed. Basic strain-measuring circuits are included.

Phantastron Circuits Using Transistors, (2 pages)
by N. C. Hekimian ..... *p 46*
Conventional pentode phantastron action depends on partition of cathode current between plate and screen grid. Since no transistor is equivalent to the pentode, phantastron characteristics are simulated by current transfer between one or another transistor. Performance resembles that of the vacuum tube circuit.

Measuring Thicknesses of Paramagnetic Coatings, (3 pages)
by P. Dick ..... *p 48*
Two meter instruments, one for the laboratory and the other portable, make accurate, nondestructive thickness measurements of paramagnetic coatings and platings on nonmagnetic bases. The coating creates imbalance in a field, yielding output voltage proportional to thickness.

Simulator Tests Radar Tracking Systems, (3 pages)
by O. B. Mitchell ..... *p 51*
Missile and aircraft radar target simulator uses in-flight recordings of radar signals. When played back through simulator, signals permit precise evaluation of radar range performance of airborne equipment under dynamic target conditions.

Medical Electronics Part III: Therapeutic Devices, (7 pages)
by W. E. Bushor ..... *p 54*
A survey of electronic and nucleonic equipment and techniques used for medical therapy and surgery. Topics include treatment or surgery with x-ray, radiation, ultrasonics, diathermy and with heart stimulators and other devices.

Common-Mode Rejection in Wideband D-C Systems, (2 pages)
by J. L. Kimball ..... *p 61*
Two wideband d-c amplifiers are used to give a differential amplification channel with common-mode rejection of 130 db. The second amplifier cancels the common-mode voltage. One important use is in data acquisition systems.

MARCH 3, 1961, ISSUE

Designing Thin Magnetic Film Memories for High-Speed Computers, (3 pages)
by E. E. Bittmann, ... *p 39*
Thin film memories are produced uniformly by vacuum deposition in a magnetic field. A typical package of 16 memory planes with printed conductors stores 2,560 bits, equivalent to 320 eight-bit words. A driving circuit is also described.

Direction Finder Helps Recover Discoverer Capsule, (4 pages)
by A. T. Lloyd ..... *p 42*
Acting as a long-range target acquisition system, the direction finder locates reentering satellite capsule within a 70-degree sector and from 50,000 feet to sea level. Outputs of two Yagi antennas appear side-by-side in a visual indication of signal source direction.

Logic Combines Tunnel Diodes with Transistors, (2 pages)
by R. W. Lade ..... *p 46*
Tunnel diode switching speed and transistor isolation capabilities are combined, yielding logic circuits with switching speeds of 0.7 nanoseconds. AND and OR circuits and typical input and output waveforms are given.

Designing Chopper-Stabilized Operational Amplifiers, (3 pages)
by R. B. Fradella ..... *p 48*
Design procedures and practical circuits are given for chopper-stabilized, transistor, operational amplifiers for such applications as airborne controls and mobile analog computers.

Probe Identifies Cable Wiring, (1 page)
by J. S. Rushton ..... *p 51*
The desired wire of a multiconductor cable is connected at one end to ground and at another point to an a-c source. The magnetic probe locates the wire by sensing the current in it. Pickup is amplified to energize indicator relay.

Epitaxial Process Improves Transistor Characteristics, (2 pages)
by W. D. Roehr ..... *p 52*
Incorporating the epitaxial process in production of mesa transistors improves characteristics. The epitaxial mesa is described and comparative tests of epitaxial and premium-quality conventional mesa transistors are detailed.

Electromechanically-Scanned Trough Waveguide Array, (4 pages)
by W. Rotman and A. Maestri ..... *p 54*
Electrical characteristics of a trough waveguide are altered to yield a 50-degree scan. Motor-driven obstructions are introduced into the waveguide so that propagation of energy is changed from a nonradiating to a radiating mode.

Optically Projecting Data on a Cathode Ray Tube, (2 pages)
by H. H. Naidich ..... *p 58*
Maps or grids are obliquely projected on to the face of a radar display cathode ray tube so that they appear to be in the same plane as the phosphor surface. Map slides are predistorted, to compensate for projection distortion, by photographing them on a dummy crt.

MARCH 10, 1961, ISSUE

Solid-State Modulators for Infrared Communications, (5 pages)
by P. W. Kruse and L. D. McGlauchlin ..... *p 177*
Gun-like infrared transceivers provide secure, reliable, highly directional voice communications. Principle of free-carrier absorption by semiconductors can be extended to optical space communications and other applications. Infrared absorption of germanium is modulated by the microphone signal, modulating the infrared transmitted. An infrared detector in the receiver modulates the output.

Engineering Highlights of the 1961 IRE Convention, (4 pages)
staff report ..... *p 182*
Papers reviewed cover developments in laser radar, antennas, tunnel diode circuits, semiconductor filters, solid-state display devices, depletion-layer ultrasonic transducers, thermoelectric spot cooling, photoelectronic reconnaissance system, gallium-arsenide transistors and microminiature packaging.

Coupling Circuit Extends Magnetic Recorder Response, (2 pages)
by G. N. Johnson, W. R. Johnson and J. T. Mullin ..... *p 186*
Unusual coupling circuit between the reproduce head and preamplifier extends the low-frequency response of a video tape recorder. A separate low-frequency amplifier and a recording head divided into low- and high-frequency components handle signals. Modifications to the tape drive mechanism reduce wow and flutter to below 0.1 percent.

Frequency Conversion Technique Improves System, (3 pages)
by W. C. Hollis ..... *p 188*
Space vehicle tracking preamplifier incorporates a parametric amplifier to lower the system noise figure below 2 db. Signals of 225 to 260 Mc are raised in frequency to X-band in a varactor up-converter, amplified and down-converted.

Using Time-Compression Techniques in Digital Correlation, (3 pages)
by M. Rosenbloom ..... *p 191*
Digital circuits take incoming and reference signals, speed them up and compare them in a correlator. The techniques, chiefly delay line time-compression can be used in many types of signal processing, including sonar, loran, radar, telemetry, spectrum analysis. Signals are compressed for real-time operation with no loss of information.

Ultrahigh Frequency Doubler Circuit Has Broad Bandwidth, (2 pages)
by A. Kiriloff ..... *p 194*
Stability and bandwidth of a 650-Mc doubler is improved by using a combination input quarter-wave coaxial cavity and output plate rectangular cavity. This design gives low interference between cavities and utilizes the optimum mode.

Measuring Human Work Performance, (2 pages)
by J. Goldman and D. K. Ross ..... *p 196*
Ultrasonics are used for time and motion studies, fatigue analysis, medical studies and to design work for the physically handicapped. Acoustic energy from a transducer on the body member is transmitted to three microphones placed in mutually-perpendicular axes. Three-dimensional information is obtained for acceleration, displacement and velocity of each motion of the member.

MARCH 17, 1961, ISSUE

Beam Maser for 3 Millimeters Uses Hydrogen Cyanide, (5 pages)
by F. S. Barnes and D. Maley ..... *p 45*
Operating principles, design, fabrication and assembly of a 3-mm, 88-Gc hydrogen cyanide maser are detailed. It is used in studying a 3-mm Fabry-Perot interferometer, which may lead to evaluation of molecular transitions at 0.1 mm, where equipment is unavailable. Possible applications include precision frequency standard, high-frequency power source and low-noise amplifier. The poisonous HCn is chemically generated as needed. A collimator grid forms the beam. The interferometer is also described.

Storing Complete Decimal Digits with One Clock Pulse (4 pages)
by A. A. Jaecklin, ... *p 50*
Computer storage technique is based on time of magnetization of ferrite cores. Four cores store any decimal digit with only one

clock pulse. Magnetization time is proportional to number of turns in the coils for each coil. The coils and circuitry are arranged so the core storing the highest number is automatically switched before the next lowest core can be magnetized, and so on. Switching time of a laboratory model is 0.4 microseconds per unit and five microseconds per digit.

How to Measure Phase at High Frequencies, (3 pages)
by Y. P. Yu ..... *p 54*
Two classes of instruments are described, those that measure signals up to 500 Kc by squaring and averaging and those that measure at higher frequencies by nulling and comparing with a precision phase shifter. Emphasis is on the latter, describing several instruments for ranges up to 2 Gc. Phase delay is compared with a continuously variable delay standard.

Wideband Transistor Preamplifier Handles Low-Resistance Transducers, (3 pages)
by S. R. Parris ..... *p 57*
Amplifier is designed to handle low-level signals, such as those from magnetic heads and reluctance pickups, which are characterized by an equivalent signal of a few millivolts and an internal impedance (of the generator) of a few hundred d-c ohms. The circuit provides gain constant to within 3 db over a range of 10 cps to 1 Mc.

Modifying a Telemetry System for Balloon-Borne Neutron Detection, (4 pages)
by L. Hillman and R. C. Haymes ... *p 60*
Conventional meteorological radiosonde is modified by addition of two f-m subcarriers. Unique Geiger counter arrangement permits detection of primary neutrons. Neutron counter tube output activates subcarrier oscillators which frequency-modulate the r-f carrier. A-m component is removed from f-m by novel gating circuit in ground receiver.

Two-Stage Sine-Wave Clipper, (1 page)
by W. E. Nemeth ..... *p 64*
Clipper circuit using six silicon diodes and two resistors produces good quality sine waves. Output is flat-topped within two percent and ratio of rise time to half-period is 0.5 percent.

Nomogram Determines Probability of Detecting Signals in Noise, (1 page)
by D. E. Bailey and N. C. Randall ... *p 66*
Nomogram is a semiempirical solution to the integral equation relating detection threshold, noise figure and detection probability for receiving systems.

MARCH 24, 1961, ISSUE

Electroluminescent Display and Logic Devices, (5 pages)
by I. Greenberg, ... *p 31*
Photoconductive and electroluminescent techniques are combined in a group of devices that can be used for visual readouts and displays and for complex logic circuit elements. Associated circuitry, details of alphanumeric elements, large tracking boards, translators, code converters and decoders, bistable memories and types of phosphors used are among topics reviewed.

Tunnel Diode Pulse Compressor Preserves Superimposed Signal, (4 pages)
by A. A. Clark and W. H. Ko ..... *p 36*
Simple tunnel diode circuit compresses a video pulse by 6 db while preserving small signal perturbations superimposed on the pulse. Three tunnel diodes in cascade are used to get 12 db compression. Theory and experimental results are covered.

Long-Wire Antenna for Meteor Burst Communications, (3 pages)
by D. K. Reynolds and J. M. Bartlemay ..... *p 40*
An unusually simple antenna system is suitable for radio communications in the 30-100 Mc region. Signals are propagated along paths established by reflections from ionized meteor trails in the outer atmosphere. Advantages of the antennas over Yagis generally used are reviewed as is the role of antennas in meteor burst systems.

Pulse Commutator Simulator Uses Magnetic Logic Elements, (3 pages)
by J. Porter ..... *p 43*
A PAM/PDM commutator simulator simulates the output of a telemetering commutator, enabling ground station equipment testing without commutator wear. Circuitry is given for a 28-channel, 30-pulse system, but techniques are applicable to other systems and pulse groups. Magnetic shift registers are used as synchronous or ring counters.

Collecting Data from Live Missiles in Flight, (4 pages)
by R. C. Wright ..... *p 46*
Telemetering system small enough to go into operational missiles is silent unless abnormal conditions are detected. Data and missile event commands are displayed on an oscilloscope. Free-running multivibrator 32-channel scanner encodes data into single pulse-coded signal for transmission over a single subcarrier channel.

Measuring Semiconductor Junction Capacitance, (1 page)
by G. C. Summers ..... *p 50*
Diode or transistor junction capacitance can be measured by Q meter, reactance drop method or modified L-C meter. Methods and advantages and disadvantages of each test are described.

Calculating Transformer Coupling Coefficients, (1 page)
by D. E. MacLaughlin and Herbert F. Spirer ..... *p 52*
Q meter or grid dip meter measures resonant frequencies of r-f transformers. These values are applied to nomograph to find the coefficient. Graphs for high and low values of the coefficient are given.

MARCH 31, 1961, ISSUE

Cooling Transistors with Thermoelectric Elements, (3 pages)
by J. R. Fortier and C. S. Thompson . *p 43*
Thermoelectric coolers can be used for local cooling of hot transistors with little additional increase in chassis mass and volume. The coolers remove approximately 2.5 times more heat than stagnant or slow-moving air. Transistors with a normal maximum temperature of 135 C may be used at 150 C and 175-200 C transistors may be used at 200-250 C. Principles and effects on transistors operating above and below normal maximum junction temperatures are discussed.

Designing Amplifiers with Nonlinear Feedback, (4 pages)
by J. C. Looney ..... *p 46*
Nonlinear elements in a transistor amplifier provide exponential response and increase dynamic range. Various techniques useful in high-gain amplifiers, such as those used in null detectors and radar receiver video sections, are discussed. Largest to smallest signal voltage ratio handled by an amplifier is 100,000 to 100 million. The amplifier is non-saturating and will tolerate distortion at large signal levels.

Electronic Signalling for Experimental Monorail, (2 pages)
by J. Juitier ..... *p 50*
Experimental French monorail train is hung from rubber-tired wheels, preventing conventional signal methods. Photocells, radiation monitors, transistorized oscillators and frequency-selective receivers keep track of train movements and activate cab signals or brakes.

Using Epitaxial Transistors in Switching and R-F Circuits, (2 pages)
by D. Hall ..... *p 52*
Silicon epitaxial transistor offers low saturation voltage, linear characteristics at low voltage and reduced switching time in switching circuits. Practical circuits, for commercial and military temperature ranges, of high-speed computer NOR gates and flip-flops and vhf amplifiers are given.

Hybrid H-Guide Feeds Flush-Mounted Antennas, (4 pages)
by G. N. Voronoff ..... *p 54*
Two-dimensional array of slot radiators is excited by a hybrid H-guide mode. The antenna is simple, can be flush-mounted, has inherent monopulse characteristics and can be used in the millemeter region. Such an antenna has been operated at X-band.

Moving Target Simulator Tests Tracking Radars, (2 pages)
by K. L. Chapman ..... *p 58*
Test set for automatic tracking radars generates many kinds of moving target radar echos. Signal strength is variable, permitting tests of weak echo sensitivity or agc. The echo can be made to move at any speed in any direction. The simulator can also be used as a signal generator to trace signals in the receiver.

APRIL 7, 1961, ISSUE

Determining Electron Density and Distribution in Plasmas, (5 pages)
by H. L. Bunn ..... *p 71*
Microwave interferometer systems determine electron density and distribution in low-temperature, magnetically-contained plasmas. After discussion of transmission and measuring factors, signal measuring and amplifying circuits for oscilloscope display are given. The interferometer is being used in thermonuclear studies, but may be used to study missile wakes and microwave components containing ionized gas.

PIN Diodes Control Shorted Stub, (2 pages)
by R. H. Mattson ..... *p 76*
Triple stub tuners, used to match any load to a transmission line over a wide range of carrier frequencies, require three variable shorted stubs. Stub length changes when the frequency changes. *Pin* diodes electronically control stub lengths in finite steps with little or no loss. A design for 225 to 400 Mc is given.

Fabricating Thin-Film Resistors, (3 pages)
by I. L. Brandt ..... *p 78*
Thin-film resistors must compromise resistance, wattage and accuracy. The concept of ohms-per-square calculation is presented and characteristics of Karma and chrome films are described in table and curves. Derating for high-temperature operation is also discussed. A typical circuit is designed step-by-step.

Designing Avalanche Switching Circuits, (7 pages)
by R. R. Rufer, ... *p 81*
High-power, high-speed switching can be obtained from transistors operated in the avalanche mode. Avalanche operation is

received and a criteria for selecting transistors with this property is developed. The basic avalanche circuits and factors influencing design and application are discussed. Included is a test circuit for determining avalanche characteristics.

Improving Rectifier Circuits, (1 page)
by G. F. Montgomery, ... p 88
Conventional half-wave and voltage doubler rectifier circuits are modified by an inductor-input filter. The modifications reduce peak rectifier current and improve load-voltage regulation and smoothing.

Design Charts for Low-Frequency Antenna Efficiency, (2 pages)
by G. J. Monser ..... p 90
Two nomograms help estimate the conversion efficiency between transmitter power and radiated power for low-frequency transmission systems. The nomograms solve for radiation resistance and efficiency of short monopole antennas up to 0.1 wavelength.

APRIL 14, 1961, ISSUE

Microwave Swept Receiver Uses Zero Intermediate Frequency, (5 pages)
by D. W. Casey II, ... p 59
Swept-frequency receiver, for solar radiation research at 2 to 4 Gc, exhibits high sensitivity and extreme gain stability with time. The use of zero frency i-f eliminates the image rejection problem, improves the noise figure and permits the use of simple video i-f amplifiers. While the current application is at S-band, techniques are applicable to higher bands, range radar, ICBM detection and systems needing wideband, low-noise, stable receivers.

Complementary Transistors Simplify Modulator Design, (4 pages)
by J. E. Grau and B. F. Humbel .... p 64
Modulator with complentary *npn* and *pnp* transistors needs only one transformer, low power and no special power supply voltages. It has both carrier and signal suppression at the output, gain greater than 3 db and high linearity. Applications include teletype systems, speech scramblers and ssb transmitters.

Pickup Devices for Very-Low-Frequency Reception, (2 pages)
by G. C. Monser ..... p 68
The Hall effect is used to receive information transmitted at 10 cps to 10 Kc. The Hall device is compared with loop and whip antennas used over the same frequency range.

Evaluating Radio Receiver Susceptibility to Interference, (5 pages)
by B. T. Newman, H. Cahn and R. Keyes ..... p 70
Test equipment and procedures compare the abilities of a-m, f-m and ssb voice communication receivers to function in a crowded or artificially-jammed spectrum. Standards are based on an ideal receiver with easily defined characteristics of selectivity, dynamic amplitude range, depression, impulse suppression and audio response.

A-C Controlled Half-Cycle Magnetic Amplifier, (3 pages)
by E. Van Winkle ..... p 75
Four self-saturating elements, each consisting of a core and a rectifier, are combined with a transistor preamplifier to provide a jet fuel flow indicator system circuit. In servomotor applications, the circuit offers a-c control, low time constant and good output waveform.

Stabilized Delay Circuit Provides High Accuracy, (2 pages)
by C. K. Friend and S. Udalov .... p 78
Timing error sources are minimized in this solid-state, voltage-controlled timing delay generator. The sawtooth generator function is incorporated in the gate generating circuit. Time delay accuracy is better than 0.7 percent, stability is better than 0.2 percent of full scale over a temperature range of 24 C. Applications include radar range tracking.

APRIL 21, 1961, ISSUE

Optical Ranging System Uses Laser Transmitter (3 pages)
by M. L. Stich, E. J. Woodbury and J. H. Morse ..... p 51
Coherent light beam from ruby maser provides optical radar (Colidar) range of two to three miles from breadboard model. Monochromatic emission enables receivers to discriminate, through filters, between signals and sunlight noise. This allows long-distance ranging in the daytime. The system transmits with an angular beamwidth of one minute of arc.

Prepunched Cards Test Data-Link Modules (4 pages)
by W. Mergner and J. A. Paschall ... p 54
Designed for use by relatively unskilled personnel, this tester performs dynamic gono-go tests on some 180 removable modules of Air Force date link equipment. Card punches direct switching of test inputs, detecting and evaluating circuits. Proper indicating lamp patterns and meter readings for each module are printed on the cards. Faults can be traced to a particular component. Operation for typical logic modules is detailed.

Designing Low-Current Thermoelectric Coolers (3 pages)
by R. M. Jepson and G. G. Messick .. p 58
Advances in thermoelectric materials enable Peltier coolers to operate at low currents and voltages. Procedures for determining device configuration and for calculating device parameters are illustrated by tracing the development of a three-stage cooler for an infrared detector cell.

Measuring Frequency Stability of Pulsed Signals (5 pages)
by R. H. Holman and R. B. Shields . p 61
Short-term frequency stability of pulsed r-f systems is measured without synchronization or reference to a signal source. The tester operates on the principle that instability results in pulse-to-pulse phase variation. The phase of a received pulse is compared, via stalos and bipolar detectors, with the remembered phase of a previous pulse.

One-Transistor Single Shot (1 page)
by T. F. Heiting ..... p 66
Components required for a single-shot multivibrator can be reduced by 50 percent with a circuit employing a transistor, inductor, Zener diode and lesser components. Not necessarily cheaper, circuit may be more reliable and simpler to manufacture than conventional types.

Predicting Spurious Transmitter Signals (3 pages)
by J. G. Arnold ..... p 68
Spurious signals that may be produced by an initial r-f transmitter design must be accurately predicted so that interference can be avoided. Determining interference from cascaded amplifiers and multipliers involves not only driving frequency, but harmonics and mixed spectrums as well. Tabular approach greatly reduces the calculations needed for prediction.

APRIL 28, 1961, ISSUE

Computers Today (32 pages)
by F. Leary ..... p 63
Special report surveys the computer industry and associated technologies. Among the topics discussed are applications and capabilities of present-day equipment, design trends, systems development for information processing, retrieval, communications and automatic industrial process control. Research and engineering of new forms of logic, new materials and components, important advances in systems design, heuristic research, self-organizing systems and polymorph or multiple computers are stressed.

Designing Printed-Circuit Spiral Antennas (5 pages)
by J. J. Wolfe and R. Bawer ..... p 99
Dual-arm Archimedean spiral antennas are used as airborne uhf transmitting antennas and for other applications requiring compact design. The article describes such design considerations as effects of spiral and cavity diameters, cavity depth, spiral rate of growth, spiral type, feed structure and antenna performance criteria. A balun feed design is also reviewed.

Simulating War Games with Analog Computer (4 pages)
by V. J. Caggiano ..... p 104
Computer simulates a flight of six airplanes independently maneuvering to attack a target, as defense command responds to simulated radar target information. The operator feeds maneuver controls to the computer, which produces signals representing the attackers' range, elevation and azimuth.

Improving Gain Control of Transistor Amplifiers (3 pages)
by J. S. Brown ..... p 108
Transistor characteristics and temperature sensitivity make agc difficult to use in transistor amplifiers. However, if each amplifier stage is given an agc loop through an electronic attenuator, stability and noise figure are improved. The technique is illustrated in a three-stage i-f amplifier for a double-conversion superheterodyne receiver.

Binary-to-Decimal Display Uses Magnetic Stepping (3 pages)
by R. J. Miller ..... p 111
Any number of binary digits are converted to their scaled decimal equivalent. The binary signal is converted so that in each decade a bit is represented as only one of 10 possible selections. The signal then determines position of a decimal display wheel which is essentially a synchronous motor. Each wheel operates independently.

Tandem-Transistor Circuit Regulates Fluorescent Lamp (2 pages)
by L. L. Blackmer and A. T. Wright . p 114
Light output of a hot-cathode fluorescent lamp is kept linear with current by a dimmer circuit which modulates the d-c input at varying rates. This permits continuous, automatic luminance control for photographic printing.

MAY 5, 1961, ISSUE

Solving Design Problems in All-Magnetic Logic (6 pages)
by U. F. Gianola ..... p 61
Surveys theory and developments in all-magnetic shift registers and other logic cir-

cuits, discussing various techniques of obtaining gain, directionality, transfer, switching, readout and other functions. Emphasis is on synchronous sequential using toroidal and multiapertured cores made of rectangular hysteresis loop materials. A resume of thin-film approaches is included.

Digital Voltmeter Employs Voltage-to-Time Converter (3 pages)
by B. Parker and M. McMahan ..... p 67
Input voltages are converted to output pulses proportional to input amplitude. Output pulses gate a series of 50 Kc clock pulses whose number is proportional to input voltage. The number of pulses are counted and displayed.

Three-Phase Static Inverters Power Space-Vehicle Equipment (4 pages)
by R. J. Kearns and J. J. Rolfe ..... p 70
Solid-state inverter develops three-phase, 400-cycle, 115-volt a-c at 500 watts full load, from an input of 22 to 29 vd-c. The sinewave is obtained from a quasi-square wave developed by pulse-width modulation. Silicon controlled rectifiers are used in the power switching output stage.

Tunnel Diode Curve-Tracer Is Stable in Negative Resistance Region (2 pages)
by J. A. Narud and T. A. Fyfe ..... p 74
Bridge configuration and a low-inductance test jig enable the instrument to trace the complete characteristics of tunnel diodes having a large negative-conductance-to-capacitance ratio. Diode instability has in the past prevented curve tracing in the negative resistance region.

Cooling Transistors with Beryllia Heat Sinks (3 pages)
by K. H. McPhee ..... p 76
Properties of representative heat sink materials are tabulated to show the relative advantages of beryllium oxide. The ceramic is a good electrical insulator, an excellent heat conductor and withstands severe environments. Heat sink design is reviewed.

Digital Control Uses Unijunction Transistors (2 pages)
by F. W. Kear ..... p 79
Because they are bistable, unijunction transistors can replace many conventional components in switching circuits, reducing package size and maintenance. Applications in readout and control circuits are discussed. Circuits are given for a ring counter, motor pulse generator and pulse shaper.

How Surface Waves Propagate Along a Dielectric Sandwich (1 page)
by H. F. Mathis ..... p 82
Equivalent transmission line circuits are given for the propagation of surface waves along a dielectric sandwich lying on a ground plane. A sample problem and graphical solution are included.

MAY 12, 1961, ISSUE

Glow-Tube Programmer Controls Neutron Experiments (3 pages)
by E. W. Johanson ..... p 65
Circuits employing multielement glow tubes and transistors form program switches. The tubes can be cascaded to provide more than 10 functions. Operation of a neutron diffractometer is reviewed and the circuit for the instrument's automatic programer and printout control is given.

Three-Dimensional Core Memory Stores One Million Bits (4 pages)
by C. A. Allen, G. D. Bruce and E. D. Councill ..... p 68
Storage unit handles 16,384 words, each 72 bits long, by a three-dimensional word selection and read process. Design considerations and readout and drive circuits are given. Merits of selecting a desired word by two-dimensional or three-dimensional techniques are outlined.

Sensitive Microwave Radiometer Detects Small Icebergs (4 pages)
by T. V. Seling and D. K. Nance .... p 72
Icebergs and sea water absorb microwave energy at different rates, have different coefficients of reflectivity. By using the concept of apparent temperature to detect the difference, small icebergs that are invisible to radar can be located. The technique has other applications and can be used to make radiographs. An experimental unit operating at 9 Gc could also distinguish between ships and icebergs.

Monostable Pulse Generator Employs Zener-Diode Clamp (2 pages)
by C. M. Stewart ..... p 76
Two-transistor circuit with low output impedance gives output pulses of known length and amplitude when triggered with positive or negative external pulses. Diode voltage is set according to amplitude desired. Under some conditions of load or supply voltage, the circuit does not require the Zener diode.

Solid-State Parallel-Mode Scanner Reads System Physical Parameters (3 pages)
by S. Thaler ..... p 78
Diode circuit monitors group of resistive type transducers in parallel, rather than serially. Any abnormal condition is shown on a servo indicator or vtvm. If transistors are substituted for diodes, the location of the active transistor, and hence the location of the abnormal condition, can be indicated.

Transforming Resistance-Capacitance and Resistance-Inductance Networks (4 pages)
by H. J. Blinchikoff ..... p 82
Charts for canonic one-terminal-pair R-C and R-L networks minimize tedious transformation calculations. The charts cover all possible transformations of three-element networks and give the relevant equations.

MAY 19, 1961, ISSUE

Transmitting Facsimile Messages over Meteor-Burst Paths (5 pages)
by B. F. Gedaminski and W. G. Griffin, Jr. ..... p 85
Meteor-burst communications system transmits on real time at rates greater than 300,000 bits per second during the brief life of a satisfactory meteor trail. This eliminates need for storage of partially-transmitted messages. The forward scatter system has a range of 1,000 miles and a long-term transmission rate averaging some 2,300 bits per second. It may be used for low-quality tv as well as photographs and text.

***Step-by-Step Design Techniques for* Multilayer Thin-Film Networks (4 pages)**
by W. N. Carroll and F. F. Jenny .... p 90
Thin-film passive networks and interconnections can reduce size and weight of assemblies without appreciably increasing costs. The article describes design, materials, deposition techniques and subsequent optimization of six modules (OR NOT, transistor-resistor NOR, astable multivibrator, and a-f, i-f and r-f amplifiers). Topology of the 10-layer multivibrator is given layer-by-layer.

Emitter Peaking Improves Video Amplifier Response (2 pages)
by J. B. Fisher ..... p 94
Design of common emitter transistor video amplifiers is complicated by frequency dependence of input impedances. Emitter peaking improves response, linearity and stability and minimizes the effects of varying or different transistor internal parameters. Design equations for this type of circuit and a basic circuit are presented.

Voltage-Variable Capacitors Make a Relaxation Oscillator (3 pages)
by J. Lopez, S. J., and J. Brown ..... p 96
Resistance-inductance-capacitance, series-resonant circuit using voltage variable capacitors is powered by r-f energy. The circuit has two stable states, switching as the input signal decreases below a critical magnitude. Two circuits are connected to form a square-wave relaxation oscillator with its frequency controllable between 15 cps and 1.5 Kc.

Transformer and Shunt Transistors Regulate D-C Power Supply (3 pages)
by J. T. Keefe ..... p 99
Shunt circuit produces well-regulated d-c with high efficiency. Since the transistor regulators are in shunt, they are not subject to short circuits or overloads. The load is also protected by a Zener diode sensing circuit which feeds back a corrective signal to a constant voltage, ferroresonant transformer. Operating principle of the transformer is reviewed.

Vibrating Wire Probe Maps Magnetic Flux Fields (2 pages)
by R. J. Radus ..... p 102
Fluxmeter probe requiring only a few square microinches of sampling area has a sensitivity of 0.004 mv per gauss and an accuracy of about three percent. It uses a single induction loop vibrated at 14 Kc in the magnetic field.

Adjustable Clamp Circuit Shifts A-C Signal Level (1 page)
by H. O. Hoadley ..... p 104
Resistive load on two diodes, acting as positive and negative clamps, is proportionally adjustable. The circuit can act as a positive clamp, a negative clamp, or can be set anywhere between the two extremes by changing the potentiometer setting.

MAY 26, 1961, ISSUE

Air-Traffic Terminal Controller Computes and Sends Instruction (5 pages)
by R. Meuleman and S. D. Moxley, Jr. p 47
The AN/GSN-11 air traffic control system, designed for high-density air terminal areas, can simultaneously control 18 aircraft arrivals and six departures. It computes landing approaches, based on radar surveillance of all aircraft in the area. Voice instructions are automatically selected and transmitted to pilots in order of priority.

Gas-Filled Ultraviolet Detector Warns of *Fires and Explosions* (4 pages)
by D. H. Howling and R. C. Roxberry p 52
Detector tube that exhibits a power gain of 110 db has symmetrical electrodes, allowing operation on d-c or a-c. On a-c, the full gain inherent in gas amplification devices becomes available. Sensitive to ultraviolet, the tube can be used for communications or a variety of alarm applications. A multitube fire alarm circuit is given.

Carrier Phase Reversal Transmits Digital Data Over Telephone Lines (3 pages)
by J. R. Masek ..... p 56
Telephone line bandwidth and other limitations are overcome by the method of modulating a 1,950 cps carrier signal. ONES are transmitted as a reversal of carrier phase and ZEROS are transmitted by leaving

the carrier unmodulated. Timing information is derived from axis-crossing of the received signal. A special code ensures axis-crossing continuity and also carries sync pulses.

Transistor Amplifier Controls Remote Appliances (1 page)
by C. M. Wiley ..... *p 59*
Originally designed for television set control, this ultrasonic signal receiver is now used to control many other kinds of consumer appliances. The seven-stage transistor amplifier contains a double-fulcrum relay which acts as a mechanical discriminator, preventing triggering by stray noises.

Interstage Design for Stagger-Loaded Amplifiers (4 pages)
by L. A. Beattie ..... *p 60*
Butterworth stagger-tuned bandpass amplifiers avoid the bandwidth shrinkage which usually results from cascading amplifiers. The article describes a method for designing the interstage networks for Butterworth low-pass amplifiers which satisfy large gain and bandwidth requirements. It also describes a seven-stage cascade.

Evaluating Transmission Methods (2 pages)
by J. H. Vogelman ..... *p 64*
Transmission methods, equipment, parameters, applications, and military and commercial advantages and disadvantages of radiating and closed circuit communications systems are tabulated. Data is organized according to the various transmission media used for vlf, l-f, m-f, h-f, vhf, uhf, wire, cable and waveguide systems.

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Deep-Ocean Velocimeter Aids Sonar System Design (3 pages)
by L. Dulberger ..... *p 41*
Transistorized marine research instrument operates at maximum ocean depths. A supersonic pulse is fired through water along a fixed sound path. The received pulse is amplified and fed back to the generator, triggering the next pulse. The speed of sound in water is indicated by the pulse repetition rate. The instrument is battery-powered and connected to the surface by cable.

Staggered-Tuned F-M Discriminator Has Low Distortion, Wide Bandwith (2 pages)
by R. Federman ..... *p 44*
This discriminator was designed for applications in which linearity is important and some sensitivity can be sacrificed. Two secondary tank circuits, tuned slightly above and below carrier frequency, cancel all even harmonics. Distortion is below 0.25 percent for a frequency deviation of ± 40 Kc from a center frequency of 12.6 Mc.

Designing NOR Circuits for Maximum Reliability (3 pages)
by K. M. Trampel ..... *p 46*
All logical expressions in an entire digital switching system can be derived from a fundamental pnp transistor resistor-coupled circuit operating in the saturated voltage mode. The author gives step-by-step methods of designing for various worst-case conditions to ensure maximum reliability.

Transistor Cascode Circuit Improves Automatic Gain Control in Amplifiers (3 pages)
by J. F. Perkins, Jr. ..... *p 49*
Tuned l-f transistor amplifiers may shift in center frequency and bandwidth when agc is used. Causes of shift are analyzed and a solution, a cascode stage which isolates changing transistor parameters, is given. Experimental amplifiers were constructed to verify the analysis. A 10-Mc amplifier showed no shift over a 40-db range of agc.

Determining Phase Shift and Gain of Subaudio Differential Amplifiers (4 pages)
by W. C. Acha ..... *p 52*
Analog techniques are used to generate differential quadrature voltages at subaudio frequencies. Alternate adjustment of null ratio and phase shift controls nulls an indicator. Measurement accuracy, on missile servo amplifiers, is better than one percent for null ratio and one degree for phase shift.

Transistor Circuit Simulator (1 page)
by A. R. Berding and R. H. Breedlove . *p 56*
Considerable time can be saved in designing transistor class A amplifiers by constructing an equivalent circuit which simulates transistor operation under varying conditions. The simulator determines approximate bias point limits, a-c gain and input impedance.

Letter Code Designations for Microwave Bands (1 page)
by L. V. McNamara ..... *p 58*
The microwave band and sub-band letter designations are tabulated in order, along with their frequency and wavelength ranges. The letter codes given are those which originated as military project security codes. These are generally accepted in the industry, but are not necessarily official.

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Electronics in Europe (32 pages)
by W. W. MacDonald ..... *p 65*
Special report describes business and technical trends in the European electronics industry. Research and development activities in the agencies and leading firms of England, France, West Germany, Holland, Italy, Sweden and Switzerland are reviewed. New developments in instruments, communications equipment, radar, television, components, semiconductor devices and other fields are summarized. Business topics include the effects of the European electronics boom on exports, joint ventures and marketing methods, manpower problems, technical education and salary scales.

Modifying Vidicon Camera Chain for Slow-Scan Television Systems (3 pages)
by F. F. Martin and C. T. Shelton .. *p 101*
Slow-scan techniques permit relatively low-power, narrow-band tv transmitters. With further bandwidth reduction, telephone lines may be used. System analysis solves engineering problems, chiefly dark current increase and image erasure. An experimental four-second scan system showed a resolution of 250 lines.

Semiconductors Improve Reliability of Steel-Mill Control Equipment (4 pages)
by T. E. DeVincy ..... *p 104*
Environment-sensitive electromechanical motor controls on a steel strip welding and coiling line are replaced with circuits employing silicon controlled rectifiers, transistors and magnetic amplifiers. As opposing banks of photocells sense the depth of a loop in the steel, the speed of d-c driving motors is regulated by changing their field current.

Neon Diode-Resistor Matrix Controls Electronic Typewriter (2 pages)
by M. Ruderfer ..... *p 108*
Control matrix in keyboard feeds thyratron clutch control. The clutch stops a rotating type wheel at the designated letter. Wheels with different type faces are interchangeable. Semiconductor devices may be used instead of a thyratron.

Servo Filter and Gain Control Improve Automatic Direction Finder (4 pages)
by P. V. Sparks ..... *p 110*
T-12 airborne adf uses a fixed double-loop antenna, a sense antenna and resolver, rather than conventional rotating loop. Received signals are combined in a position servo system to indicate transmitter bearing. The synchronous servo filter separates the servomotor drive voltage from voice frequencies. Agc provides uniform receiver response over a wide input range without clipping the signal at high modulation levels.

One-Shot Gating Circuit Generates Sinewaves for Testing Counters (3 pages)
by V. Kenn ..... *p 114*
An accurately-known number of high-frequency sinewaves, for testing high-frequency counters, are produced either one-time or repetitively by one-shot logic and gate control of the passage of bursts from a frequency generator. The logic circuit, actuated by a one-shot pushbutton, ensures accuracy of pulse generator output. Number of waves is controlled by pulse width adjustment.

Comparing Resistances with Oscillator and Oscilloscope (1 page)
by A. Kislovsky ..... *p 118*
Known and unknown resistances and resistance-capacitance combinations are compared by observing their damping effect on a shock-excited oscillator. Measuring range is 100 ohms to 100 kilohms with accuracy of five percent.

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Electrodynamic Loudspeaker Has Totally-Active Surface (3 pages)
by S. R. Rich ..... *p 49*
Radiating surface areas of this loudspeaker are true pistons. The bass piston is non-resonant and pneumatically-coupled to a small driver; the treble piston has a distributed current-carrying winding in a magnetic flux sheet perpendicular to the wire direction and diaphragm motion. High-fidelity frequency and transient response are reported.

Heart-Sound Discriminator Simplifies Medical Diagnosis (4 pages)
by R. Weiss ..... *p 52*
Complete heart cycle is recorded with a time reference. The recording is played through an analyzer with a gate self-synchronized to select only the sound of interest. The voltage pulse which occurs in the heart muscle at the start of a cycle is picked up, amplified and used as a trigger pulse. The system can be used for physician training as well as patient examination.

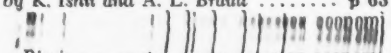
Microwave Isolator Combines Hall Effect and Tunnel Diodes (2 pages)
by C. H. Hubbard, L. A. LoSasso and E. Rousso ..... *p 56*
Hall plate isolator gives a useful gain-bandwidth product of 200 to 300 Mc with available tunnel diodes. A three-terminal plate, made of zinc-doped InSb and having an impedance of 25 ohms, eliminates the necessity for impedance transformers and other limiting components. Circuit parameters are adjusted by varying plate temperature with a thermoelectric cooler.

Video Distribution Amplifier Eliminates Interstage Transformers (4 pages)
by H. H. Naidich ..... *p 58*
Automatic-gain-controlled video distribution amplifier for facsimile handles high-level inputs and outputs over a bandwidth of 1.5 cps to 12 Mc. Distortion in the push-pull amplifier is cancelled by control and

differential amplifiers. Keyed clamping and positive and negative feedback are used in the agc loop. The circuit can be used for television with minor modification.

Multiaperture-Core Counters Give Nondestructive Readout (3 pages)
by W. R. Johnston ..... **p 62**
Single-stage binary counters with blocking oscillator action are connected in series, one counter driving the next. Nondestructive readout allows the counter to function as a register. Slight modification converts the binary counter code to decimal for display. In a typical application, missile guidance commands are delivered at appointed times. Ordinary cores can be used for destructive readout.

Crystal Biasing Improves Millimeter-Wave Detector (1 page)
by K. Ishii and A. L. Brault ..... **p 65**



Biasing a crystal diode detector economically improves millimeter-wave detector gain. In a 73-Gc receiver, biasing improved gain 20 db, decreased the noise figure and raised sensitivity. This is a revival of a technique used before electron tubes were invented.

D-C Voltage Comparator Circuit Uses Tube and Transistor (1 page)
by R. D. Valentine ..... **p 66**
Levels of sawtooth inputs with durations up to several minutes are compared with a d-c reference voltage. An output pulse is generated when the two inputs coincide. A junction transistor is the switch in a regenerative circuit which combines desirable features of both blocking oscillator and multiar circuits.

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Medical Electronics Part IV: Prosthetic Devices for the Senses (7 pages)
by W. E. Bushor ..... **p 43**
Electronic aids for the hard of hearing, deaf and blind are reviewed, along with basic body processes for hearing and seeing. Topics include bone conduction, air conduction and tactile hearing aids; artificial ears and mastoids; sonic, ultrasonic, uhf, i-f, visible light and ultraviolet light guidance aids for the blind; reading machines and artificial eyes.

Satellite Sounder and Telemeter Charts Ionosphere Electron Density (4 pages)
by S. Horowitz and L. Humphrey **p 50**
Satellite-based radar indicates the electron density profile above the F-layer. For each transmitted pulse, two are received (ordinary and extraordinary). The instrumentation discriminates between these two and traces them on a virtual-height-versus-frequency plot. Data is recorded and transmitted to ground on command.

Controlled Rectifier Produces Quarter-Megawatt Pulse Power (2 pages)
by H. G. Heard ..... **p 54**
Size and weight are reduced in line-type modulators when solid-state components are used. Efficiencies are 92 to 95 percent. Circuits are given for a 250-Kw, 360-pps pulse modulator and its trigger generator. Silicon controlled rectifiers are used as switches.

Random Pulse Generator Tests Circuits, Encrypts Messages (4 pages)
by B. K. Eriksen and J. D. Schmidt .. **p 56**
Shift-register pulse generator uses high-speed logic to produce complicated pulse sequences up to four billion bits long. The modulo-2 addition technique is improved to circumvent complexity and decrease components. These generators are suitable for data transmission system error rate tests and scrambling high-security communications.

Portable Propellor Flowmeter Determines Water Velocity (2 pages)
by L. Molyneaux and J. M. Edington . **p 59**
Designed for biological research, this flowmeter measures water velocities from one inch to six feet per second. The water driven propellor modulates a 15-Kc signal, which is demodulated, rectified and integrated to drive a velocity indicator. A detector circuit compensates for changes in water conductivity.

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Radar-Computer Output Display Point-Plots Alphanumeric Characters (5 pages)
by K. E. Perry and E. J. Aho ..... **p 75**
Calliscope (calligraphic oscilloscope) displays computer outputs as labeled points and written notations. The display rate for points and symbols is 13,500 per second. There are 64 electronically generated characters, formed by electron beam spot deflection. A Fourier synthesis technique generates X and Y voltage waveforms needed to form the characters.

Designing Solid-State Inverters to Replace Sine Wave Sources (4 pages)
by D. Levy ..... **p 80**
Solid-state inverters can operate equipments requiring sinusoidal a-c, if the square wave output is modified to have the same rms and average values as the pure sine wave. A simple saturable reactor is placed in series with the load, or a magnetic amplifier is used. Design of a typical 400 cps supply is traced. Data on core materials is also given.

Four-Layer Diode Triggers High-Voltage Pulse Generator (2 pages)
by N. C. Hekimian and P. M. Schmitz **p 84**
Simple generator for electrographic recording uses a four-layer diode to discharge a capacitor through a pulse transformer primary. Ouptut is 1 Kv at 10,000 pps. A transistor lockout circuit prevents the diode from remaining conductive. The circuit is useful for high-voltage, low-current supplies with minimum peak-to-average power requirements.

Microwave Transmission Line Measurements with a Sampling Oscilloscope (3 pages)
by H. Halverson ..... **p 86**
When a pulse is launched down a transmission line, a portion is reflected from discontinuities. A sampling oscilloscope may be used to interpret the reflection and determine transmission line characteristic impedance, discontinuity, relative attenuation between cables and velocity of propagation.

Outside-Coil Magnetic Head Improves High-Frequency Recording (3 pages)
by M. Camras and R. Sears .... **p 89**
Magnetic tape recording head has its coil outside, permitting the air gap to be reduced to microinches. The new design is suited to low-speed, megacycle recording with high tape packing densities. Development, performance figures and core materials are discussed.

Designing Shunt Voltage Regulators (1 page)
by M. Beebe ..... **p 98**
Equations given enable voltage regulators of the Zener diode reference or shunt transistor type to be designed for minimum circuit power dissipation if input and output voltage ranges and load current requirements are known. Optimum input voltage and series current limiting resistor are determined under worst case conditions.

Graphical Design Procedures for Maximally-Flat Microwave Filters (3 pages)
by M. Chomet ..... **p 94**
When microwave filters require a bandwidth of 10 percent or less, simplifications in the design equations permit graphical solutions. Charts tell how many resonators are needed to meet desired filter characteristics.